AN INJECTOR FOR GASEOUS FUEL

The present invention relates to an injector for gaseous fuel suitable for use in single- or dual-carburation engines running on liquefied petroleum gas (LPG) or the like.

In this application, the injector serves to introduce gaseous fuel at a determined flow rate into a combustion chamber of the engine.

BACKGROUND OF THE INVENTION

Such an injector generally comprises a body provided with a fuel feed duct and with a duct for delivering fuel from the injector. The feed duct and the delivery duct each has a first end opening out to the outside of the body for connection respectively to the fuel tank or to the combustion chamber of the engine, and a second end opening out into a chamber of the body having mounted therein a valve member and means for actuating the valve member between a closed position in which the valve member is pressed against the second end of the delivery duct, and an open position in which the valve member is spaced apart from the second end of the delivery duct in order to define a flow section. This flow section is cylindrical in shape and of area equal to the product of the circumference of the second end of the delivery duct multiplied by the distance between the second end of the delivery duct and the valve member when in the open position. This distance corresponds to the stroke of the valve member. The flow section as defined in this way defines the flow rate with which fuel is delivered to the combustion chamber, and must therefore be precise since it influences the performance of the engine.

Unfortunately, the stroke of the valve member depends on the dimensions of the member itself and of certain components of the actuator means, and also on the clearances that exist between these various elements. The accuracy of the stroke thus depends on the quality of

the machining and on the quality of the assembly of said elements, thus making manufacture of the injector difficult. In addition, the effects of temperature, shocks, vibration, or more generally wear, all lead to modifications (only temporary for temperature) to the dimensions and the clearances defining the stroke, such that the flow section and thus also the delivery flow rate do not remain constant over time.

OBJECT OF THE INVENTION

It would therefore be advantageous to have an injector capable of delivering fuel without unexpected variations in flow rate.

BRIEF SUMMARY OF THE INVENTION

To this end, the invention provides an injector for gaseous fuel, the injector comprising a body provided with a fuel feed duct and with a fuel delivery duct, the feed duct and the delivery duct opening out into a chamber of the body in which there are mounted a valve member and actuator means for actuating the valve member between a closed position and an open position in which the valve member defines a fuel flow section, the delivery duct including a calibrated segment of section smaller than the flow section defined by the valve member when in the open position.

Thus, the section of the calibrated segment determines the delivery flow rate independently of the stroke of the valve member.

Other characteristics and advantages of the invention appear on reading the following description of a particular and non-limiting embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference is made to the accompanying drawings, in which:

- Figure 1 is a diagrammatic section view of an injector in accordance with the invention, the valve member being in its closed position; and

- Figure 2 is a fragmentary diagrammatic view on a larger scale and in section of said injector, with the valve member in its open position.

DETAILED DESCRIPTION OF THE INVENTION

By way of example, the injector described herein is intended for fitting to the engine of a motor vehicle.

With reference to the figures, the injector in accordance with the invention comprises a body given overall reference 1, which body is implemented in the example shown in two portions, namely: a top half-body 2 and a bottom half-body 3 that are fastened together.

The top and bottom half-bodies 2 and 3 define between them a chamber given overall reference 4, into which there opens out a fuel feed duct 5 and a fuel delivery duct given overall reference 6.

The fuel feed duct 5 is formed in the bottom half-body 3 and possesses one end that opens to the outside of the body 1 for connection to the fuel tank of the motor vehicle, and an opposite end that opens out into the chamber 4.

The fuel delivery duct 6 is formed in an endpiece 7 mounted on the bottom half-body 3 so that the fuel delivery duct 6 possesses an end that opens out outside the body 1 for connection to the combustion chamber of the engine, and an opposite end that opens out via an opening 8 into the chamber 4.

The delivery duct 6 has a frustoconical segment 9 extending from the opening 8 to a calibrated segment 10, tapering towards said calibrated segment, followed by a terminal segment 11 which is connected to the calibrated segment 10.

The frustoconical segment 9 possesses an angle at the apex of less than 55°, and which is preferably

substantially equal to 40°, as shown. This value serves to limit disturbances of flow rate in this segment.

The calibrated segment 10 presents a section which is designed to correspond to the delivery rate that is to be supplied by the injector. The terminal segment 11 is of section that is not less than that of the calibrated segment 10.

The delivery duct 6 is also arranged to ensure that the flow speed of the fuel in the calibrated segment 10 is solid. In this way, a delivery flow rate is obtained that is substantially constant in spite of variations in the pressure downstream from the calibrated segment 10.

The chamber 4 is subdivided into a top compartment 12 and a bottom compartment 13 (top and bottom relative to the orientation of the injector shown in the figures) by means of a diaphragm 14 which extends transversely to the axis of the delivery duct 6 at the opening 8. The diaphragm 14 has a peripheral edge 15 held captive between the top half-body 2 and the bottom half-body 3, a central portion 16 in register with the opening 8 in order to form a valve member, and an intermediate portion 17 connecting the peripheral edge 15 to the central portion 16. The intermediate portion 17 is elastically deformable so that the central portion 16 of the diaphragm 14 can move between a closed position (see Figure 1) in which the central portion 16 is pressed against the edge of the opening 8, and an open position (see Figure 2), in which the central portion is spaced apart from the edge of the opening 8, and co-operates therewith to define a cylindrical flow section for the fuel. The area of the cylindrical flow section is equal to the product of the circumference of the opening 8 multiplied by the distance between the edge of the opening 8 and the central portion 16 of the diaphragm 14. The circumference of the opening 8 and the distance between the edge of the opening 8 and the central portion 16 of the diaphragm 14 are designed so that the

cylindrical flow section is greater than the section of the calibrated segment 10 so that the rate at which fuel is delivered is determined by the section of the calibrated segment 10 and not by the cylindrical flow section.

The injector has means for actuating the central portion 16 of the diaphragm 14 to move between its open and closed positions. These actuator means are housed in the top compartment 12 of the chamber 4 and comprise a magnetic core 18 surrounded by a coil 19 associated with means 20 providing a connection with an electrical power supply (not shown). It will be observed that in order to improve return of the central portion 16 of the diaphragm 14 to its closed position, a fraction of the fuel taken from the feed duct 5 is delivered into the top compartment 12 in order to establish a backing pressure therein.

As an indication, for an opening 8 having a diameter of 8 millimeters (mm) and a diaphragm having a central portion 16 with a stroke of 0.3 mm, the calibrated segment 10 has a diameter of about 2 mm.

Naturally, the invention is not limited to the embodiment described and variants can be applied thereto without going beyond the ambit of the invention as defined by the claims.

In particular, the structure of the injector may be different from that described, and for example the bottom half-body 3 and the endpiece 7 may be made as a single part. The actuator means may also be different and could, for example, incorporate mechanical means for returning the valve member into its closed position, e.g. a spring.

Furthermore, the numerical values mentioned are given purely by way of example.